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ABSTRACT

This paper discusses some of the ways one can study graphics on the Apple II microcomputer. Much attention is given to specialized use of software packages used in dumping graphics, and the saving or storing of binary files of graphic images. Knowledge of BASIC at more than a cursory level is required, but a step-by-step procedural outline is presented for those who are not accomplished programmers. Sections of the paper focus on (1) high resolution memory pages and binary storage, and (2) specific examples of capturing, saving, and dumping high resolution graphics, with five illustrations included. Seven references are provided. (MNS)

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CAPTURING GRAPHICS FROM OTHER SOURCES

DUMPING THEM AND INTEGRATING THEM INTO BASIC

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A Presentation

by

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INTRODUCTION

Applications of the microcomputer to the area of graphics is a very diversified field of study. This paper discusses some of the ways one can study graphics on the Apple II Microcomputer. It is a revision and an extension of a paper completed in 1985 by Fletcher and Ruckman (1). This presentation goes beyond the former presentation in the discussion of capturing graphics from other software programs, saving them as binary files, and calling them into programs in Applesoft BASIC. This paper does not cover such areas as dumping graphics with special interface cards and some of the other topics included in the earlier paper.

Much of the content of this paper relates to the specialized use of software packages used in dumping graphics. Considerable attention is also given to the saving or storing of binary files of graphic images. Storing files in this manner requires special attention to memory locations in the Apple II Microcomputer. Full understanding of this topic requires knowledge of more than a cursory level of BASIC programming. Since the author is not an accomplished programmer, the presentation will be reduced to a step by step procedural outline which can be followed by other individuals who have similar levels of training.

HIGH RESOLUTION MEMORY PAGES AND BINARY STORAGE

The primary storage area on the Apple II is specific for certain types of computer input. Memory locations from 0 to 767 are for storing system programs, stack, and keyboard buffers. Locations from 768 to 1007 are used to store shape table information or short machine language programs. Special monitor addresses are stored in locations 1008 to 1023. The memory locations for text material and low resolution graphics occupy the same storage areas. The main storage page (page 1) for these modes is at memory locations from 1024 to 2047. Page 2 storage for these modes is from memory locations 2048 to 3071. Programs written in BASIC are stored in locations beginning at 2048 and ending at 8191. The two formats for high resolution graphics, HGR and HGR2, are stored in two different locations. The high resolution page for graphics created under the HGR mode are stored in memory locations from 8192 to 16383. Storage of graphics created with HGR2 are in memory locations from 16384 to 24575. Storage of input from the Disk Oprating System is in memory locations from 38400 to 49151. Haskell(2)

Experienced programmers can move into other designated areas by using Peek and Poke commands. There are specially desigated memory locations between 49152 and 65535 which relate to the language card for the Apple II. In these areas one can load other languages such as Integer BASIC, FORTRAN, and any of the several other languages which are available for the Apple II. This area of memory must be installed on the Apple II and Apple II+ in Slot 0. It is built into the mother board for the Apple IIE and Apple IIC. Also, the additional memory which can now be added to the Apple II, up to 3.0 megabytes or beyond, can be addressed directly by a programmer. This memory is now being used by some individuals as a temporary high speed additional disk

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drive used to speed up the operation of programs by changing the process from a mechanical to an electronic input.

Since most software programs used in graphic dumps are written for high resolution graphics, it is essential that graphics developed in low resolution be changed into high resolution format. This is accomplished with a binary program which converts the entire screen from low to high resolution format. This author has used two equally successful programs for accomplishing this task. One is included in the software program named Printographer (3) and another included in an article by Steinborn(4). Once the program is converted from low resolution to high resolution graphic format, the procedure for saving, loading, and dumping the file is the same for the low resolution graph as for the one created in high resolution. It is noted that it is difficult to convert the file from low to high resolution if you cannot retain the file on the screen while getting out of the program and into Appesoft BASIC. This is not as much of a problem when working with high resolution graphics because they are stored in separate memory areas from the text and BASIC programs. If these graphic pages are not disturbed by another graphic program, they will be retained in memory even while booting up the D.O.S. so long as the new diskette does not contain another graphic and the power is not turned off. Examples of this are discussed in detail in the ensuing pages of this paper.

Saving a high resolution graphic located in one of the high resolution memory pages to diskette can be easily accomplished if you can retain the graphic in memory. When breaking out of the program you will either retain or reboot the D.O.S., then you use the BSAVE format for saving the file. When using BSAVE versus SAVE one must add additional information which specifies the beginning and ending of the memory location for the file. One can save either the HGR or the HGR2 pages by using specific information, in hexidecimal format, which corresponds to the decimal memory locations discussed earlier. To save a high resolution graphic created and stored in the HGR page of memory as a binary file one can use - BSAVE filename, A$2000, L$3FFF. You may use from L#1FFF to L$5FFF depnding on te size of the file. To save a high resolution created in HGR2 one would use - BSAVE filename,A$4000,L$5FFF. This information plus additional tables correlating decimal and hexidecimal locations are included in a book by Poole, et.al. (5)

SPECIFIC EXAMPLES OF CAPTURING, SAVING, AND DUMPING HIGH RESOLUTION GRAPHICS (BOTH HGR AND HGR2)

Following are a number of examples, described step-by-step, for using the information discussed above. Details for creating the graphics are also included for the benefit of those who have little mastery of programming in graphics and who may not have had experience with the various software programs used in this presentation.

Example 1 - Low Resolution Graphic

To create a simple low resolution graphic in BASIC on the Apple II you should first boot up a D.O.S. 3.3 data diskette then type and

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run the following program:

```
NEW
10 GR :COLOR=15
20 VLIN 0,39 AT 0:VLIN 0,39 AT 19:VLIN 0,39 AT 39
30 HLIN 0,39 AT 0:HLIN 0,39 AT 19:HLIN 0,39 AT 39
RUN
```

A graphic similar to a window should appear on the screen. You can save this as an Applesoft BASIC file by typing SAVE FILENAME such as:

```
SAVE  WINDOW
```

This does not store the graphic, only the file which creates it. To save the file as a graphic or to dump the graphic to the printer you must first convert it to a high resolution graphic by running the conversion program from one of the two previously mentioned software programs:(Printographer or Steinborn)

```
BRUN LOW TO HIGH.RM  (FROM PRINTOGRAPHER)
BRUN LORES TO HIRES  (FROM STEINBORN)
```

Following this procedure there is no apparent change on the monitor but the program can now be treated as a high resolution graphic. To save the file to your D.O.S. data diskette you must save it as a binary file using such a procedure as follows:

```
BSAVE WINDOWGRAF, A$2000,L$1FFF
```

Check your diskette by typing:

```
CATALOG
```

If properly stored it should appear on the catalog as:

```
B 034 WINDOWGRAF
```

To call this program back into another program written in Applesoft BASIC, you should use this sequence of commands at the proper time:(Line numbers will depend on when you want to call for the graph. You may want to load it into memory early in the program and call for it at a later time.)

```
10 PRINT CHR$(4) "BLOAD WINDOWGRAF,A$2000"
```

The above command loads the graph into memory in the HGR page for graphics. To bring the graph to screen type:

```
20 POKE -16297,0
30 POKE -16301,0
40 POKE -16300,0
50 POKE -16304,0
SAVE LOADER (Though not essential, saving this file will save time
later.)
```


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RUN

The graphic should appear immediately. If this is the end of the program the graph will remain on the screen, if it is not it will appear for only an instant and the next part of the program will replace it. To show the graphic for a specified period of time you must slow the system with a counting loop or a wait time command. An example of a counting loop follows:(This will keep the graphic on the screen for approximately five seconds.)

```
60 FOR N = 1 TO 5000: NEXT N
```

To dump the graphic to the Apple Dot Matrix Printer or to the Apple Imagewriter Printer you can use one of these two software packages, Printographer or Imagewriter Tool Kit. Printographer allows for more options including the ability to trim the graphic, something usually essential when dumping a converted low resolution graphic. Following are the procedures when using each of these two software programs.

After completing the conversion from low to high resolution shown above the first step is to insert the Imagewriter Tool Kit D.O.S. 3.3 version and type:

```
RUN HELLO
```

When the screen flashes a 1 for printer interface slot, press the RETURN key. Select the option, SHOW GRAPHIC, from the menu by pressing the number 2 on your keyboard. Press the number 3 to CHANGE THE PRINT FORMAT and the number four to SELECT FULL PAGE INVERSE. Press the ESC key to return to the main menu followed by selecting the option for PRINTING THE GRAPHIC, 4 on the keyboard. The graphic dump should begin if the printer is on and properly installed.

If you intend to use the Printographer program you should also use the diskette both for the low to high conversion and for the printer dump. It is essential that the Printographer program be properly installed for your particular printer and interface card. This program can be matched to almost any type of printer and interface by using the installation routine on the diskette.

Upon completion of the low to high resolution conversion, insert the printographer program diskette in drive one and type:

```
RUN PRINTOGRAPHER
```

When the menu appears with choices, choose the second option, SELECT FROM MEMORY, if the graphic is already in the memory of the computer, or if you wish to load a binary file directly to the machine, choose the first selection on the menu. There are numerous options which can be taken if alteration of the graphic is desirable. To dump the graphic to the printer choose the letter 'p' from the menu. Trial printings by choosing various settings will produce the outcome you wish.

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Example 2 - High Resolution Graphic Page 1

Much of what has been discussed in the previous section applies to a high resolution graphic created under the HGR or page 1 format. Once the graphic has been developed or captured from another program, there is no need to do the low to high conversion and the remaining procedures outlined above are identical. Following are the steps in creating a simple high resolution graphic for high resolution memory page 1:

```
NEW
10 HGR:HCOLOR=7
20 HPLOT 0,0 TO 279,0 TO 279,159 TO 0,159 TO 0,0
30 HPLOT 0,0 TO 279,159:HPLOT 0,159 TO 279,0
40 HPLOT 139,0 TO 139, 159:HPLOT 0,79 TO 279,79
RUN
```

This plot will create a window like structure with diagonals which can be saved similarly to the previous procedure described above. Following are the commands for saving the file in BASIC and in binary:

```
SAVE HGRWINDOW
BSAVE HWINDOWGRAF,A$2000,L$1FFF
```

All other references for dumping and recalling the graphic are the same.

Example 3 - High Resolution Graphic Page 2 or HGR2

The use of HGR2 is similar to HGR but the HGR2 format uses the entire screen. Following is an example of the creation of a high resolution graphic and the procedure for saving it as a file in BASIC and in binary format.

```
NEW
10 HGR2:HCOLOR=7
20 HPLOT 0,0 TO 279,0 TO 279,179 TO 0,179 TO 0,0
30 HPLOT 0,0 TO 279,179:HPLOT 0,179 TO 279,0
40 HPLOT 139,0 TO 139,179:HPLOT 0,89 TO 279,89
RUN
```

The graphic created will be similar to that which was created in the HGR format except for the vertical dimensions. To save this graphic in BASIC and as a binary file follow these steps:

```
SAVE HGR2WINDOW
BSAVE HGR2WINDOWGRAF,A$4000,L$1FFF
```

A CATALOG of your diskette should reflect the saved files. To recall these files from the diskette and to dump them to a printer is done similarly but there are a few changes. Interestingly, you can load a binary file back into a BASIC program to either page 1 or page 2 regardless of which page you used in creating it before it was stored on the diskette. Since you can only dump the graphic with the

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Imagewriter Tool Kit if it is in memory location for page 1, it is advised that you load the graphic directly from the diskette as was shown above. If you wish to have one graphic in memory location page 1 and another in memory location page 2 and toggle between them you would need to use Printographer to dump the graphic in page 2 to the printer. Also, the poke commands are slightly different for calling on the graphic in page 2 of the Apple's memory. Following is a sample program for loading two different files in the two memory locations and toggling back and forth between them.

```
NEW
10 PRINT CHR$(4) "BLOAD HWINDOWGRAF,A$2000"
20 PRINT CHR$(4) "BLOAD HGR2WINDOWGRAF,A$4000"
30 POKE -16297,0
40 POKE -16301,0
50 POKE -16300,0
60 POKE -16304,0
70 FOR N = 1 TO 5000 :NEXT N
80 POKE -16297,0
90 POKE -16302,0
100 POKE -16299,0
110 POKE -16304,0
120 FOR N = 1 TO 5000:NEXT N
130 GOTO 30
SAVE DOUBLELOADER
HOME  (This clears the screen.)
RUN
```

It is assumed that the binary files which were called for in the preceding program are on the data diskette D.O.S. 3.3 in drive one. Also, the reason the loader file was saved to the data diskette was to enhance the acquisition of these files when you wish to use them at a later date, and you can edit new filenames into this loader file when you decide to change graphics.

Example 4 - Capturing Graphics from Other Programs

Most of the graphics generated by software programs are in one of the high resolution formats. This discussion relates only to capturing graphics which are in high resolution format since the procedures which are followed would destroy the low resolution graphic. The only way known to this writer to capture a low resolution graphic is to carefully get into BASIC mode without losing the image nor the D.O.S. and run one of the convert programs to change it to high resolution. If you can break out of a software program with CTRL C followed by pressing the RETURN key you will not interfere with the graphic on the screen nor with the disk operating system. Storing or dumping the graphic is easily accomplished by following the procedures outlined above.

It is generally true that if a high resolution graphic can be generated by any software program it can be captured, stored as a binary file, and dumped to the printer. Once the graphic is on the screen of the monitor or you know it is stored in one of the memory pages for high resolution graphics the following steps are used for

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accomplishing this feat:

STEP 1 - Place an initialized data disk for D.O.S. 3.3, which has no graphic images in the HELLO file, in drive one and press CTRL and RESET. This will either drop you into BASIC or boot the data diskette. This is true even though you may be in PRODOS. If it boots the data diskette go to STEP 3. If it drops you into BASIC go to STEP 2.

STEP 2 - Boot the disk with PR#6 and RETURN. This enables you to get the disk operating system back into the memory of the microcomputer. Do not use CTRL OA RESET for it will destroy the clarity of the graphic.

STEP 3 - Save the file in binary as shown above and dump it to the printer with Printographer. It is important to note that the Printographer program allows you to dump graphics from memory page 2 while this writer has not been able to do that directly with the Imagewriter Tool Kit. Once saved to the diskette, the file can be loaded back into any program in BASIC as noted above. Also, you may wish to bring the graphic into a program such as Apple Mechanic (6) where you can use the many fonts available with this program or the additional data diskette, Typefaces (7). This can serve as an interesting way to dress up a graphic with as many as 30 different fonts. This procedure is outlined below:

Example 5 - Writing on High Resolution Graphics

Mixing text generated with various fonts with high resolution graphics can be accomplished many ways. A simple procedure used by this writer is to create or capture the graphic and store it as a binary file. Once this is accomplished you can follow these steps to bring the graphic back into Apple Mechanic, complete your lettering, and restore or dump the graphic in the revised form.

STEP 1 - Boot the Apple Mechanic program diskette and select the option to RUN XTYPER. Select the option to clear the high resolution screen.

STEP 2 - Place the data disk with the binary graphic file in drive one. Select the option to load the graphic to memory. When the filename is requested, type it in the specified space and pressing the RETURN key.

STEP 3 - Place the diskette, either Apple Mechanic or Typefaces, for loading the font types in drive one and select up to three different fonts.

STEP 4 - Go into the format for editing your graphic by pressing the RETURN key.

STEP 5 - Place your data diskette back in drive one and select the option for saving the file under a new name. If you wish you can go back to BASIC by quitting the program and save the file in binary as outlined above. Saving the file by either procedure is adequate. To

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dump the graphic to the printer follow the steps outlined above.

SUMMARY AND IMPORTANT NOTE

*IMPORTANT NOTE: THE IMAGEWRITER TOOLKIT SOFTWARE DOES NOT WORK WITH THE APPLE IIC MICROCOMPUTER SYSTEM AND THE APPLE PRINTERS. THE PRINTOGRAPHER SOFTWARE PROGRAM DOES WORK WITH THE APPLE IIC SYSTEM.

This paper has covered some of the options for creating, saving, dumping, and calling up graphic files. As you work through the paper I am sure that you will find many other options not selected by this writer. Also, you will surely begin to grow in your knowledge of the way information is stored in the Apple II microcomputer. This writer would be pleased to hear from you if you can add appreciably to what is presented in this paper. My full address follows:

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